DECLARATION

I, Teruo ARIMA , a national of Japan, c/o Asamura Patent Office of 331-340, New Ohtemachi Building, 2-1, Ohtemachi-2-chome, Chiyoda-ku, Tokyo, Japan do hereby solemnly and sincerely declare:-

1) THAT I am well acquainted with the Japanese language and English language, and

2) THAT the attached is a full, true, accurate and faithful translation into the English language made by me of Japanese Patent Application No. 2-329009.

The undersigned declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001, of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 1st day of February , 2000.

Teruo ARIMA

2-329017

APPLICATION FOR PATENT

Commissioner
The Patent Office

Title of the Invention: DRAWING MANAGEMENT DEVICE

Number of Claim(s) for a Patent: 3

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List of the annexed documents:

(1) Specification ..... 1 copy

(2) Drawings ..... 1 copy

(3) Power of Attorney ..... 1 copy

(4) Duplicate of Patent Application Form ..... 1 copy

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SPECIFICATION

1. Title of the Invention

DRAWING MANAGEMENT DEVICE

2. Scope of Claims for a Patent

1. A drawing management device arranged to store a facility drawing of an overall facility as digital information, retrieve a necessary facility drawing, and then display the facility drawing on a display device, characterized by representing a magnitude of a data amount of a target drawing to be retrieved through a depth of a three-dimensional form of a retrieval icon on a display surface of said display device.

2. A drawing management device as claimed in claim 1, wherein the display of the three-dimensional form of said retrieval icon may be optionally switched on and off.

3. A drawing management device as claimed in claim 1, wherein the data amount of said target drawing to be retrieved may be collected at each display request level.

3. Detailed Description of the Invention

[Industrial Field of Utilization]

The present invention relates to a drawing management device for managing the drawings of facilities such as a pipe laying system of a water and gas supply and a wiring system for electric power and telephone in the

form of their digitized information.

[Prior Art]

Conventionally, the state of facilities such as pipe laying for a water and gas supply and wiring for electric power and telephone has been managed using the drawing drafted on a sheet of paper or polyester film. In this case, a change in the facilities requires to modify the drawing. The work of modifying the drawing must be performed by man power so that long time and much labor are required and also the possibility of erroneously modifying is relatively strong. In order to solve such a problem, it has been proposed to manage the facility drawing in the form of its digitized information. For example, as disclosed in JP-A-63-254565, the management is performed by displaying the many facility drawings (for example, topography drawings, system drawings and symbol drawings) stored in a file device on a display device to monitor them. Further, the work for modifying the drawings is also made for the drawings displayed on the display device.

[Problem to be Solved by the Invention]

In the pipe arrangement or the water supply device, the pipe-laying data about the water supply facility is structured at levels according to the way of use. Each kind of data is expressed by vector information. The plural levels of this pipe-laying data and combined arbitrarily according to the way of use and displayed on the display surface. The display is represented by

superimposing these levels of the pipe-laying data, so that the drawing retrieval time and the sophistication of the displayed result are made greatly variable depending on the amount of the pipe-laying data. Therefore, the retrieval manipulation has difficulty in grasping how long does it take to complete the display of the drawing, in advance.

The present invention is made in order to cope with the above defect of the prior art. It is therefore an object of the present invention to provide a drawing management device which provides a capability of grasping the rough data amount of the drawing to be retrieved and estimating the retrieval time of the drawing on the grasped data amount.

[Means for Solving Problem]

The foregoing object may be achieved by calculating the data amount of the pipe-laying data structured at levels in advance and variably displaying the depth of the retrieval icon according to the estimated data amount.

[Operation]

The pipe-laying data structured at levels is digitized as vector information expressed by the X and Y coordinate values. Therefore, the amount of the pipe-laying data can be calculated at each level, so that the total amount can be constantly calculated even if the combination of the display levels is varied. By cubically representing the form of the retrieval icon for retrieving

the target drawing and varying the depth of the icon according to the total data amount of the drawing to be retrieved, the rough data amount can be grasped even if the target drawing is not displayed in retrieval. Further, since the retrieval display time can be estimated by the depth of the icon, the mental irritation in a long wait for the retrieval can be solved.

[Embodiments]

Hereafter, the description will be oriented to an embodiment of the present invention with reference to the drawings.

Fig. 2 shows the basic arrangement for a drawing management device according to an embodiment of the present invention.

In Fig. 2, facility drawing data are stored in a file device 203. The facility drawing data include graphic or figure data of topography, tube paths, etc., and attribute data such as a town name, an individual name, a tube diameter and a tube kind expressed in characters and numerical values relative to the graphic. The graphic data stored are supplied from a drawing input device 204 in such a manner that the drawing drafted on a sheet of paper is scanned at regular intervals to be toned in accordance with the light and shade of the read data so that the digital image thus obtained provides encoded data. The facility drawing data is composed of a plurality of drawings as shown in Fig. 3(a) which are individually separated to provide graphic data files. The graphic data

are expressed on rectangular coordinates as shown in Fig. 3(b), in which the lengths X_0 and Y_0 of the X axis and the Y axis are determined according to the drawing size. The graphic data are expressed in such a data storage structure that they are separated in plural levels of road data, house corner data, and a tube path data. The data located at these levels are superposed as required to provide the entire graphic data as shown in Fig. 4(a). On the other hand, the attribute data are supplied to the file device 203 by using a data inputting device 208 which collectively supplies data from a keyboard 206 or a floppy disk. An operator manipulates a mouse 207 to display the drawing on a display device (CRT) 205 as follows. At first, the operator manipulates the mouse 207 to move a cursor CU to one of icons for selecting functions displayed on the CRT screen so that the function intended is specified. If the icon for 'drawing retrieval' is specified, a central processing unit (CPU) 201 searches the drawing data concerned (composed of the graphic data and their attribute data) and temporarily stores the searched data in a main memory 202. The main memory 202 serves to store the programs for executing the processing such as search and edition of the drawing data and the drawing data being processed. The drawing data temporarily stored in the main memory 202 are edited by the CPU 201 in accordance with the valid display coordinate that is a display region of the CRT 205, and then displayed on the CRT 205. The operator can recognize the contents of a target drawing

from the displayed image. Further, in order to recognize the details of the drawing, the image is displayed so as to be partially enlarged. To this end, the cursor CU is moved using the mouse 207 to specify any square region within the CRT display region in terms of ends of a diagonal line so that the drawing is enlarged or reduced. To be more concrete, a part of the drawing data stored in the main memory 202 is edited so as to be enlarged or reduced through the effect of the CPU 201 and then is displayed on the CRT 205.

In turn, the description will be oriented to the process of calculating the amount of each level of the digitized pipe-laying drawing and converting the calculated data amount into the depth of the three-dimensional representation of the icon when the retrieval icon is selected.

Fig. 1 shows an essential portion of the embodiment of the invention, which illustrates an example of a process of converting the drawing data amount into the icon three-dimensional representation through the effect of the CPU 201.

In Fig. 1, the display surface 101 is composed of an icon area 102 for mouse manipulation, for selecting a function of retrieving and modifying a target drawing, and a drawing display area 103 for displaying the drawing retrieved by manipulating the mouse. When a target facility drawing is retrieved and displayed on the drawing display area 103, the icon for the drawing retrieval is

selected. The process of three-dimensionally representing the data amount of the relevant drawing in the icon is carried out as follows.

At first, with the mouse 207 shown in Fig. 2, the cursor CU is moved on the icon region 102 located on the display surface 101 so that the cursor is located in a manner to one-to-one correspond with the manipulation of the mouse 207. The icon of 'drawing retrieval' is selectively specified. The drawing retrieval may be separated into a drawing No. Retrieval for specifying a target drawing No., an index drawing retrieval for retrieving a target drawing from the index drawing for indicating the locational relation of the overall drawing, a target object retrieval for specifying a target object, and a town name retrieval for specifying a town name. Those retrievals are used according to the way of use. When the selecting command is inputted into the CPU 201, the graphic retrieval section 107 included in the CPU 201 serves to index the target drawing data from the file device 203 and then temporarily store it in the main memory 202. The display edition section 110 serves to edit the drawing data in a manner to suit to the drawing display region 103 and then display the edited data on the drawing display region 103.

In turn, the description will be oriented to the process of reflecting the rough data amount of the target drawing on the retrieval icon for the purpose of grasping the data amount corresponding to the target drawing in

advance.

With manipulation of the mouse 207, the cursor CU is moved, so that the 'amount three-dimensional representation' icon of the icon region 102 is selectively commanded. When the selection command is inputted into the manipulation input section 104 of the CPU 201, the amount three-dimensional representation request is passed to the icon three-dimensional representing section 106. The graphic data amount calculating section 105 serves to calculate the amount of the graphic data at each level when the drawing data is registered in the graphic file of the file device 105 and then store the calculated result in the main memory 202 as shown in Fig. 5(a). The icon three-dimensional display processing section 106 serves to create the form of the icon on the basis of the total data amount calculated from the graphic data amount table at each level shown in Fig. 5(a) stored in the main memory 202 by the graphic data amount calculating section 105 in a manner to suit to the display request level of the requested drawing. The icon is formed in a manner to make the depth of the three-dimensional icon correspond with the graphic data amount as shown in Fig. 5(b). The depth of the icon is derived by determining a maximum value of the graphic data amount in advance and doing the conversion with the value as the 100% amount. The three-dimensional icon is edited as the graphic data of the icon section by the display edition section 110 and then is displayed on the drawing display region 103.

The foregoing process makes it possible to easily discriminate the rough data amount of the retrieval drawing in the form of the icon before retrieving the drawing. Hence, the retrieval time, the data processing time, and so forth can be swiftly and easily grasped.

[Effects of the Invention]

As set forth above, the present invention provides a capability of calculating a data amount at each level based on the pipe-laying drawing data in the digitized form and the total data amount and corresponding the calculated results with the depth of the three-dimensional representation of the retrieval icon. Therefore, the present invention makes it possible to grasp the rough amount of the drawing in retrieval and swiftly and easily obtain the retrieval time, the data processing time and so forth on the basis of the rough amount.

4. Brief Description of Drawings

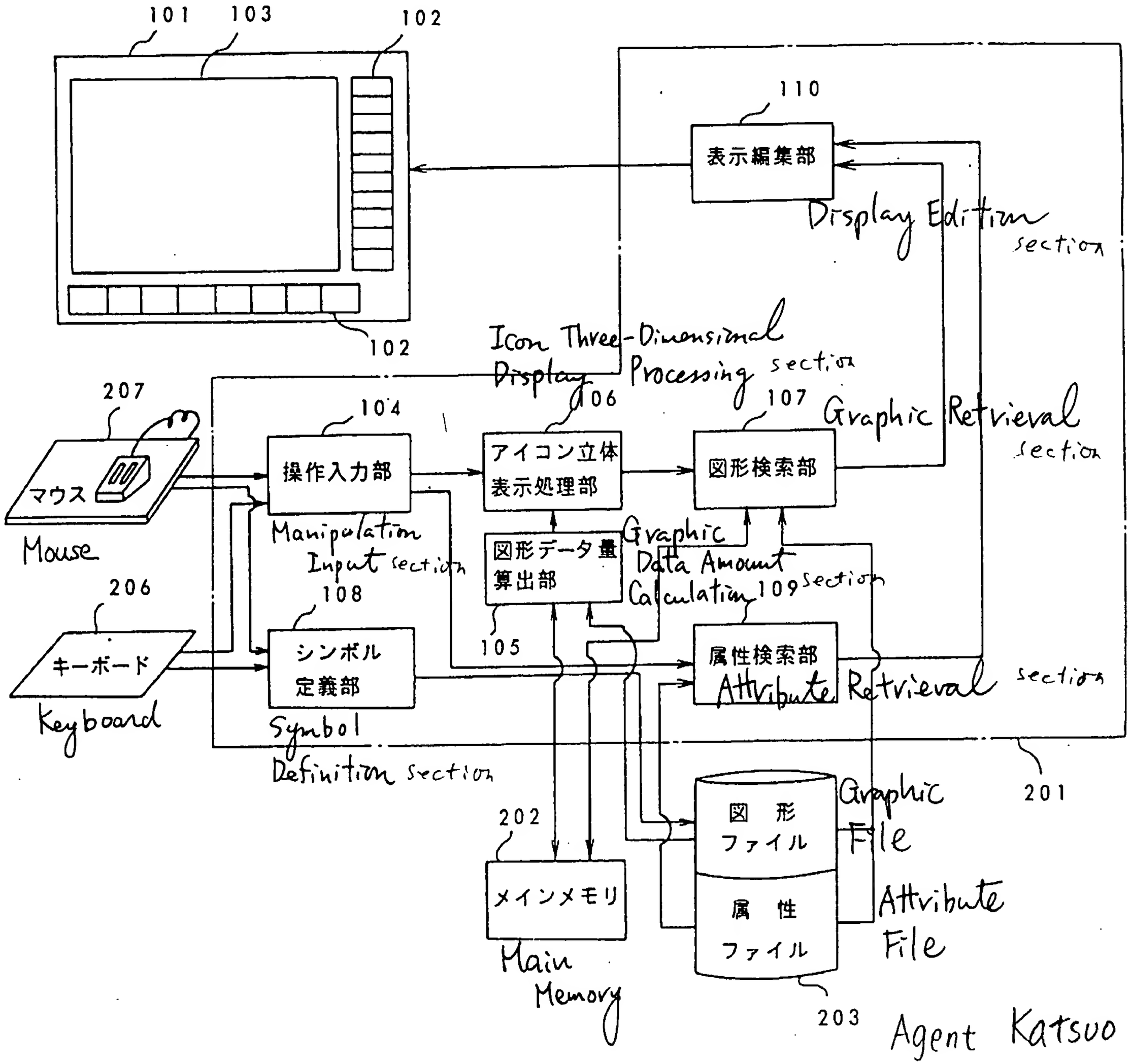
Fig. 1 is a block diagram showing an essential portion of one embodiment of the present invention. Fig. 2 is an overall block diagram showing an embodiment of the present invention. Fig. 3 is a view showing relation between a drawing configuration and a drawing coordinate location stored in a file device. Fig. 4 is a view showing a hierarchical structure of the graphic data. Fig. 5 is a view showing a process of converting the graphic data amount into a three-dimensional form of a retrieval icon

at each drawing.

101... Display Surface, 102... Icon Region, 103... Drawing Surface Region, 104... Manipulation Input Section, 105... Graphic Data Amount Calculating Section, 106... Icon Three-dimensional Display Processing Section, 107... Graphic Retrieval Section, 108... Symbol Definition Section, 109... Attribute Retrieval Section, 110... Display Edition Section, 201... CPU, 202... Main Memory, 203... File Device, 204... Drawing Input Device, 205... CRT, 206... Keyboard, 207... Mouse, 208... Data Input Device.

Agent: Patent Attorney, Katsuo Ogawa

第 1 図 Fig. 1



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第 2 図 Fig. 2

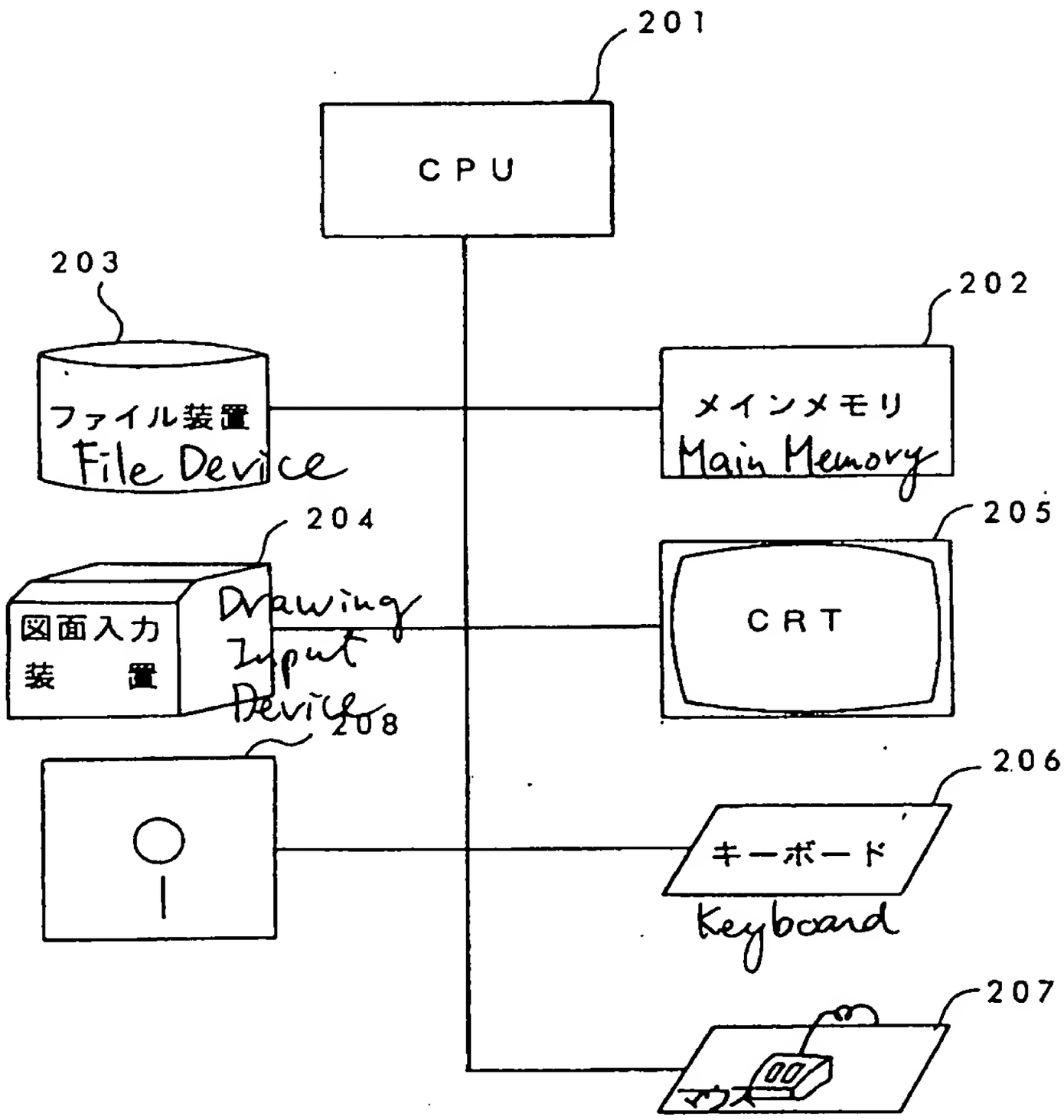

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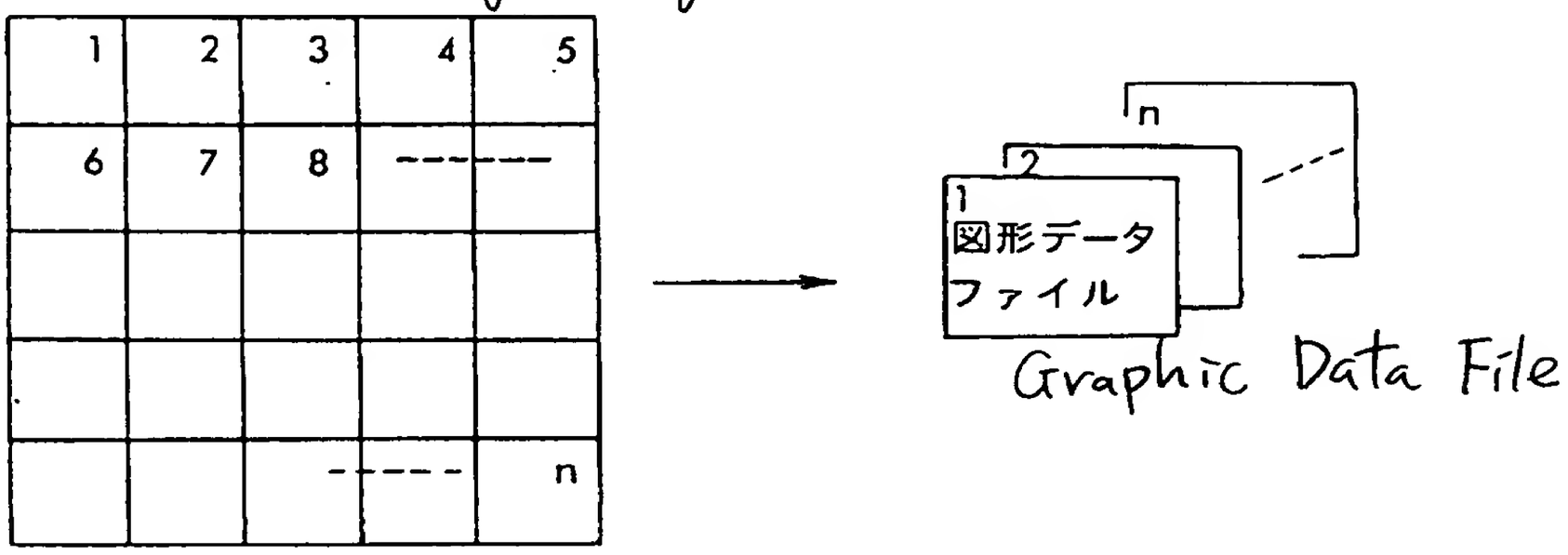
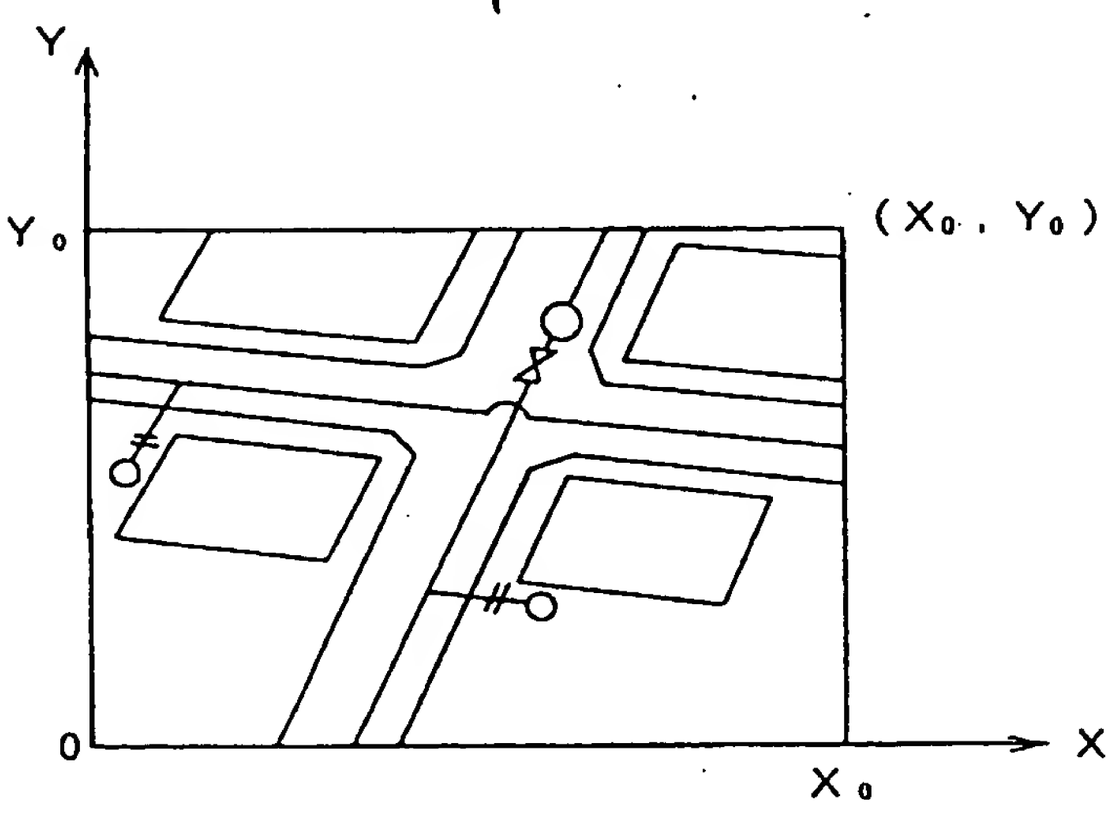
Fig. 3

第 3 図

(a) 図面構成 Drawing Arrangement



(b) 図形座標 Graphic Coordinate



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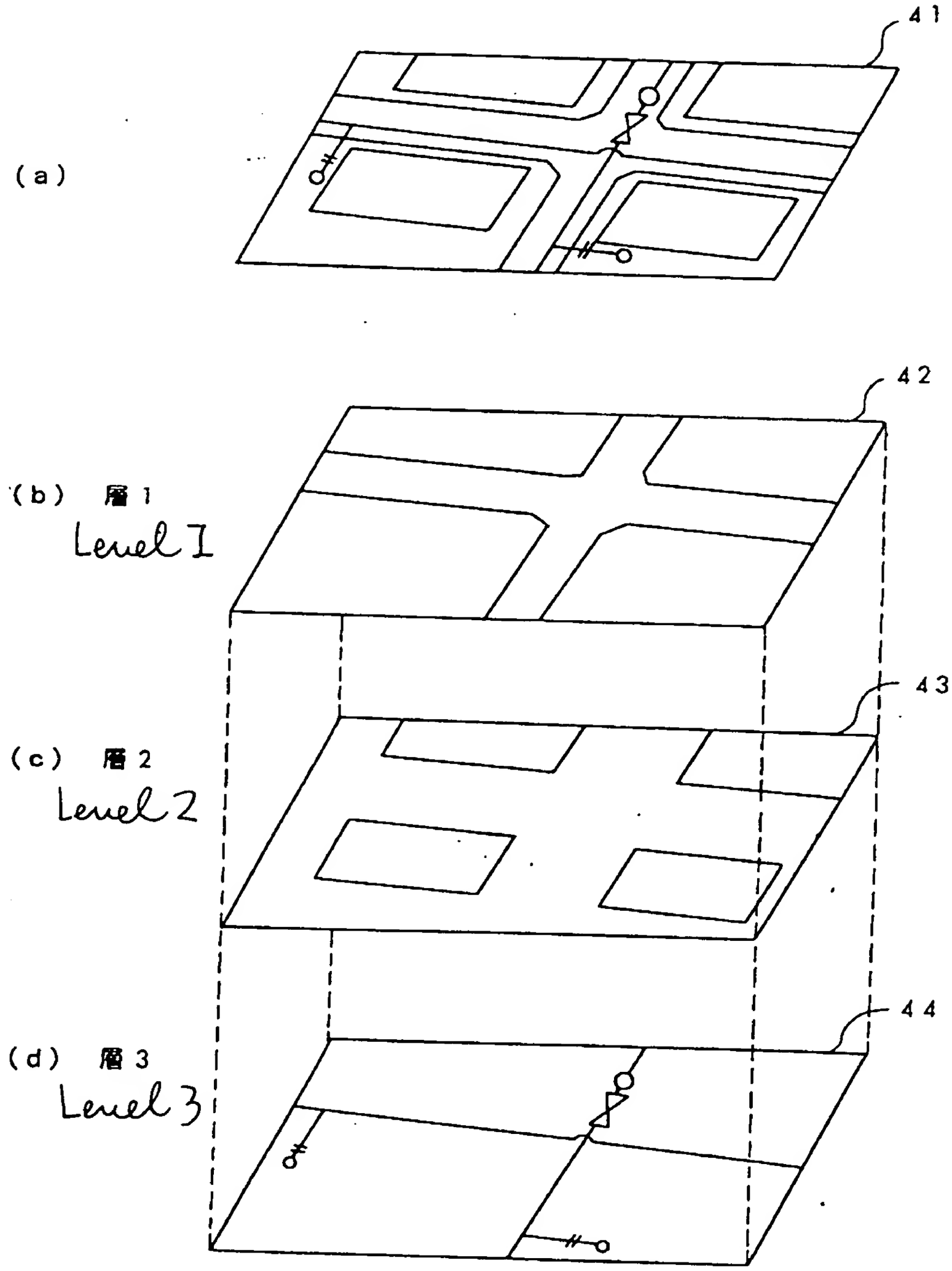
第 4 図　Fig. 4



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第 5 図

Table of Graphic Data Capacities At Individual Levels

(a) 階層別図形データ容量表

Graphic m 図形 m

階 層 No.	図形データ容量
1	m_1
n	m_n
Σ	$\sum_{i=1}^{n} m_i$

Graphic b 図形 b

階 層 No.	図形データ容量
1	b_1
n	b_n
Σ	$\sum_{i=1}^{n} b_i$

Graphic a 図形 a

階 層 No.	図形データ容量
1	a_1
2	a_2
3	a_3
4	a_4
n	a_n
Σ	$\sum_{i=1}^{n} a_i$

Level NO. Graphic Data Capacity

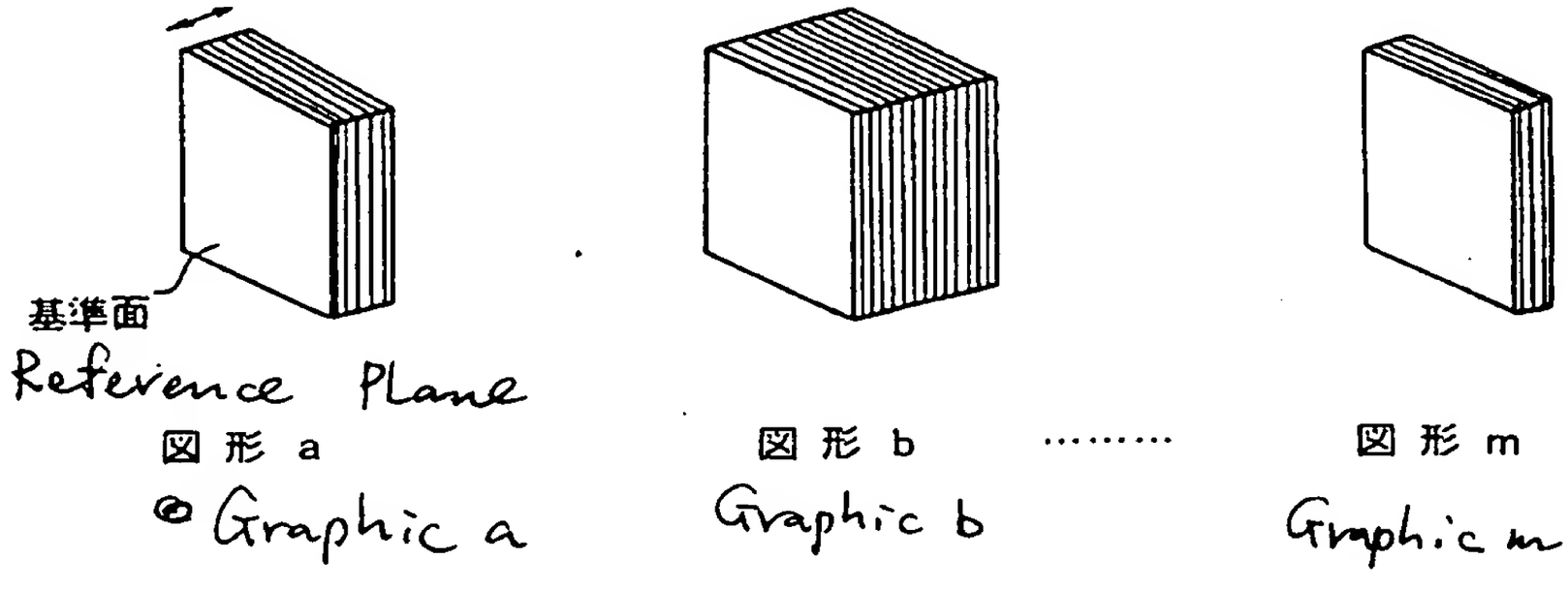
Level NO. Graphic Data Capacity

Shape of Corresponding Icon

(b) 対応アイコン形状

Depth (Corresponding to Data Amount

奥行(データ容量と対応)



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